

NOTICE OF CHANGE

METRIC

MIL-STD-1472F
NOTICE 1
05 December 2003

DEPARTMENT OF DEFENSE
DESIGN CRITERIA STANDARD

HUMAN ENGINEERING

TO ALL HOLDERS OF MIL-STD-1472F:

1. THE FOLLOWING PAGES OF MIL-STD-1472F HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
1	31 July 2003	1	23 August 1999
4	31 July 2003	4	23 August 1999
105	31 July 2003	105	23 August 1999
106	31 July 2003	106	23 August 1999
139	31 July 2003	139	23 August 1999

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-1472F will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the standard is completely revised or canceled.

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1. SCOPE

1.1 Scope. This standard establishes general human engineering design criteria for military systems, subsystems, equipment and facilities.

1.2 Purpose. The purpose of this standard is to present human engineering design criteria, principles, and practices to achieve mission success through integration of the human into the system, subsystem, equipment, and facility, and achieve effectiveness, simplicity, efficiency, reliability, and safety of system operation, training, and maintenance.

1.3 Application. This standard is applicable to the design of all systems, subsystems, equipment and facilities, except where provisions relating to aircraft design conflict with crew system design requirements or guidelines of JSSG-2010. Nothing in this standard is to be construed as limiting the selection of hardware, materials, or processes to the specific items described herein. Unless otherwise stated in specific provisions, this standard applies to design of systems, subsystems, equipment and facilities for use by both men and women. This standard is not intended to be a criterion for limiting use of materiel already in the field in areas such as lift repetition or temperature exposure time. Where the procuring activity establishes use by male personnel exclusively, the paragraphs listed in Table I are changed as noted therein.

TABLE I. Paragraph changes where exclusive use by male personnel is specified

Paragraph	Line	From	To
5.2.1.4.11	2&3	64 cm (25 in)	70 cm (28 in)
5.4.4.2	3&4	and should ... adjustment)	(delete)
5.4.4.3	4&5	The ... adjustment)	(delete)
5.6.2.1	3	5	10
5.6.2.1	3&4	“, and the total ... 5 percent”	(delete)
5.6.2.1	8	1	2
5.6.2.1	8-9	“, and the total ... 1 percent”	(delete)
5.7.2.2	2	178 cm (70 in)	188 cm (74 in)
5.7.2.3	2	165 cm (65 in)	175 cm (69 in)
5.7.2.4	2	178 cm (70 in)	188 cm (74 in)
5.7.2.5	2	135 cm (53 in)	145 cm (57 in)
	3	53 cm (21 in)	56 cm (22 in)
5.7.3.4.2	1&2	38 cm (15 in)	40 cm (16 in)
5.7.3.6	2	117 cm (46 in)	122 cm (48 in)
5.7.3.7	2	89 cm (35 in)	94 cm (37 in)
	2	53 cm (21 in)	56 cm (22 in)
5.7.3.9	2	86 cm (34 in)	89 cm (35 in)
5.7.3.10	2	74 cm (29 in)	76 cm (30 in)
5.7.5.1.4	2	69 cm (27 in)	75 cm (29.5 in)
Table XIV	A1	1.170 m (46.0 in) 1.335 m (52.5 in) 1.435 m (56.5 in)	1.210 m (47.5 in) 1.370 m (54.0 in) 1.470 m (58.0 in)
	A3&4	1.535 m (60.5 in)	1.570 m (62.0 in)
	B1	520 mm (20.5 in)	560 mm (22.0 in)
	B3&4	620 mm (24.5 in)	660 mm (26.0 in)
Figure 26	G	150 mm (6 in)	125 mm (5 in)
	H	190 mm (7.5 in)	165 mm (6.5 in)
5.7.6.1.2	4	13 kg (29 lbs)	18 kg (40 lbs)
Figure 32	B-Max	380 mm (15 in)	410 mm (16 in)
5.9.11.4.1	4 - 6	Delete second and (third) sentences	

HUMAN FACTORS AND ERGONOMICS SOCIETY (HFES)

ANSI/HFS 100 - American National Standard for Human Factors Engineering of Visual Display Terminal Workstations (DoD Adopted)

(Application for copies should be addressed to the Human Factors and Ergonomics Society, Inc., P.O. Box 1369, Santa Monica, CA 90406.)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE SI 10 - Standard Practice for Use of the International System of Units (SI) The Modernized Metric System (DoD Adopted)

(Application for copies should be addressed to the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2041 - Vibration and shock—Vocabulary
ISO 2631-1 - Mechanical Vibration and Shock—Evaluation of Human Exposure to Whole-body Vibration—Part 1: General Requirements
ISO 2631-2 - Mechanical Vibration and Shock—Evaluation of Human Exposure to Whole-body Vibration—Part 2: Continuous and Shock-induced Vibration in Buildings (1 to 80 Hz)
ISO 5805 - Mechanical Vibration and Shock—Human Exposure—Vocabulary
ISO 9241-9 - Ergonomic Requirements for Work with Visual Display Terminals, Part 9 - Requirements for Non-Keyboard Input Devices

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J925 - Minimum Access Dimensions for Construction and Industrial Machinery (DoD Adopted)

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO Soldier Target Audience Description, RTO-TR-22, AC/323 (HFM)TP/20, August 2000

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

5.6 Physical accommodation.

5.6.1 General. Systems, equipment, (including life support and emergency escape), and facilities used by operators, maintainers, and supporters shall be designed for full use by the range of service personnel with applicable operational clothing, protective clothing, and specialized equipment. Clothing and personal equipment (including protective or specialized equipment worn or carried by the individual) shall also be designed and sized to accommodate the size range of using personnel. Physical accommodation is defined as having adequate reach, strength, and endurance necessary to perform all physical tasks; adequate clearance for movement, to ingress/egress work area, and perform all required tasks; adequate internal and external visibility to perform all required operations and adequate fit of personal protective equipment to successfully perform all mission duties while receiving optimal protection from adverse environmental threats and conditions (e.g., weather, darkness, lasers, acceleration forces). The population(s) to be accommodated should include applicable joint-service and foreign military personnel.

5.6.2 Special conditions and populations.

5.6.2.1 Special conditions. Under ordinary situations, the total percentage of men excluded by the design for all physical factors (size, weight, reach, strength, and endurance) shall not be greater than 5 percent, and the total percentage of women excluded by the design for all physical factors (size, weight, reach, strength, and endurance) shall not be greater than 5 percent. Where failure to accommodate the size or performance of personnel could result in a hazardous condition leading to personnel injury or equipment damage, the total percentage of men excluded by the design for all physical factors (size, weight, reach, strength, and endurance) shall not exceed 1 percent, and the total percentage of women excluded by the design for all physical factors (size, weight, reach, strength, and endurance) shall not exceed 1 percent.

5.6.2.2 Special populations. Where equipment will be used only by selected or specialized segments of the military population (e.g., Air Force flight crews, Navy divers), the characteristics of the job population may be used instead of the entire service population. This, however, does not change the need to accommodate maintenance and support personnel. Where equipment is intended for use both by US and foreign military personnel, appropriate anthropometric and performance data on such populations shall be used for design and sizing criteria (e.g., the NATO Soldier Target Audience Description).

5.6.3 Anthropometric data. Many anthropometric data sets, particularly on military populations are available in electronic form. New anthropometric technologies enabling measurements not previously possible are emerging. Designers should take advantage of these new capabilities to obtain new data to meet requirements in 5.6.2. For general design guidance, see dimensions for the standing body, seated body, depth and breadth, circumferences and surfaces, hands and feet, and head and face in MIL-HDBK-759. MIL-HDBK-743 should be consulted for more extensive data.

5.6.3.1 Use of anthropometric data. Use of anthropometric data as design criteria shall consider (a) the nature, frequency, safety, and difficulty of the related tasks to be performed by the operator or wearer of the equipment; (b) the position of the body during performance of these

tasks; (c) mobility or flexibility requirements imposed by these tasks; and (d) increments in the design-critical dimensions imposed by the need to compensate for obstacles and projections. Where design limits based on safety and health considerations are more conservative than performance criteria, they shall be given preference.

5.6.3.1.1 Adjustments. Because the above-cited anthropometric data represent nude body measurements, suitable adjustments in design-critical dimensions shall be made for light or heavy clothing, flying suits, helmets, boots, body armor, load-carrying equipment, protective equipment, and other worn or carried items.

5.6.3.1.2 Clearance dimensions. Clearance dimensions (e.g., minimum dimensions for passageways and accesses), must accommodate or allow passage of the body or parts of the body, and must also accommodate all required tasks associated with that access.

5.6.3.1.3 Limiting dimensions and dynamic characteristics. Dimensional and dynamic limits (e.g., maximum limits for reach distance, control movements, test point locations, operating forces) must be related to performance of tasks before being substituted for performance criteria.

5.6.3.1.4 Adjustable dimensions. Seats, restraint systems, safety harnesses, belts, controls or any equipment that must be adjusted for the comfort or performance of the individual user shall be adjustable for the range of personnel using them.

5.6.3.1.5 Multiple dimension accommodation. Where more than one human characteristic or ability must be accommodated simultaneously (e.g., fit, reach, and vision), design parameters shall be defined using the multivariate distributions of all design variables.

5.6.4 Strength. Because of the low correlation between strength and body size, body measurements shall not be used to define accommodation requirements for strength and endurance. Rather, strength and endurance of the user population shall be considered separately from body size characteristics.

5.6.4.1 Operability. To ensure operability, the strength and endurance characteristics of weakest users performing a task must be accommodated. Because human strength and endurance are task-specific, operability accommodation must be based on performance of the actual or equivalent task. Where accommodation is based on strength or endurance from a different task, there must be a valid physical relation between the performance of the two tasks.

5.6.4.2 Break strength. Where critical items may be damaged by the exertion of large forces, the break strength shall not be less than can be exerted by the strongest person.

5.9.11.3.3 Load size. The maximum permissible weight lift limits in Table XVII apply to an object with uniform mass distribution and a compact size not exceeding 46 cm (18 in) high, 46 cm (18 in) wide, and 30 cm (12 in) deep (away from the lifter). This places the hand holds at half the depth, or 15 cm (6 in) away from the body. If the depth of the object exceeds 61 cm (24 in) the permissible weight shall be reduced by 33 percent. If the depth of the object exceeds 91 cm (36 in), the permissible weight shall be reduced by 50 percent. If the depth of the object exceeds 122 cm (48 in), the permissible weight shall be reduced by 66 percent.

TABLE XVII. Maximum design weight limits

HANDLING FUNCTION	POPULATION	
	Male and Female	Male Only
A. Lift an object from the floor and place it on a surface not greater than 152 cm (5 ft) above the floor.	16.8 kg (37 lb)	25.4 kg (56 lb)
B. Lift an object from the floor and place it on a surface not greater than 91 cm (3 ft) above the floor.	20.0 kg (44 lb)	39.5 kg (87 lb)
C. Carry an object 10 m (33 ft) or less.	19.0 kg (42 lb)	37.2 kg (82 lb)

5.9.11.3.4 Obstacles. The values in Table XVII assume that there are no obstacles between the person lifting and the shelf, table, bench or other surface on which the object is to be placed. Where a lower protruding shelf or other obstacle limits the lifter's approach to the desired surface, the weight limit of the object shall be reduced by 33 percent for an obstacle protruding 300 mm (12 inches), 50 percent for an obstacle protruding 460 mm (18 inches), and 66 percent for an obstacle protruding 610 mm (24 inches). If the allowable weight must be reduced by both oversize load considerations (paragraph 5.9.11.3.3) and the obstacles considerations, only the more restrictive single value shall apply; two reductions shall not be applied.

5.9.11.3.5 Carrying limits. The weight limit in Table XVII condition C shall be used as the maximum value in determining the design weight of items requiring one person carrying of objects a distance of up to 10 m (33 ft). The maximum permissible weight for carrying also applies to an object with a handle on top, such as a tool box, which usually is carried at the side with one hand. Double this weight carrying limit shall be used as the maximum value in determining the design weight of items requiring two-person carrying, provided the load is uniformly distributed between the two carriers. Where three or more persons are carrying a load together, not more than 75 percent of the one-person value may be added for each additional person and provided that the object is sufficiently large that the workers do not interfere with one another while carrying the load. In all cases involving carrying, it is assumed that the object is first lifted from the floor, carried a distance of 10 m (33 ft) or less, and placed on the floor or on another surface not higher than 91 cm (36 in). If the final lift is to a higher height, the 152 cm (5 ft) lift height applies as the more limiting case.

5.9.11.3.6 Carrying frequency. The reduction formula expressed in paragraph 5.9.11.3.2 shall be applied to repetitive carrying in the same manner as for repetitive lifting.

5.9.11.3.7 Object carry size. The reduction formula expressed in paragraph 5.9.11.3.3 shall be applied to size of objects to be carried in the same manner as for load size.

5.9.11.3.8 User population. The "Male and Female" population values in Table XVII shall apply to any object to be lifted or carried manually; the "Male Only" population values apply only as specified by the procuring activity.